

Open System Architecting

25 October 2000

Jerry Murdock

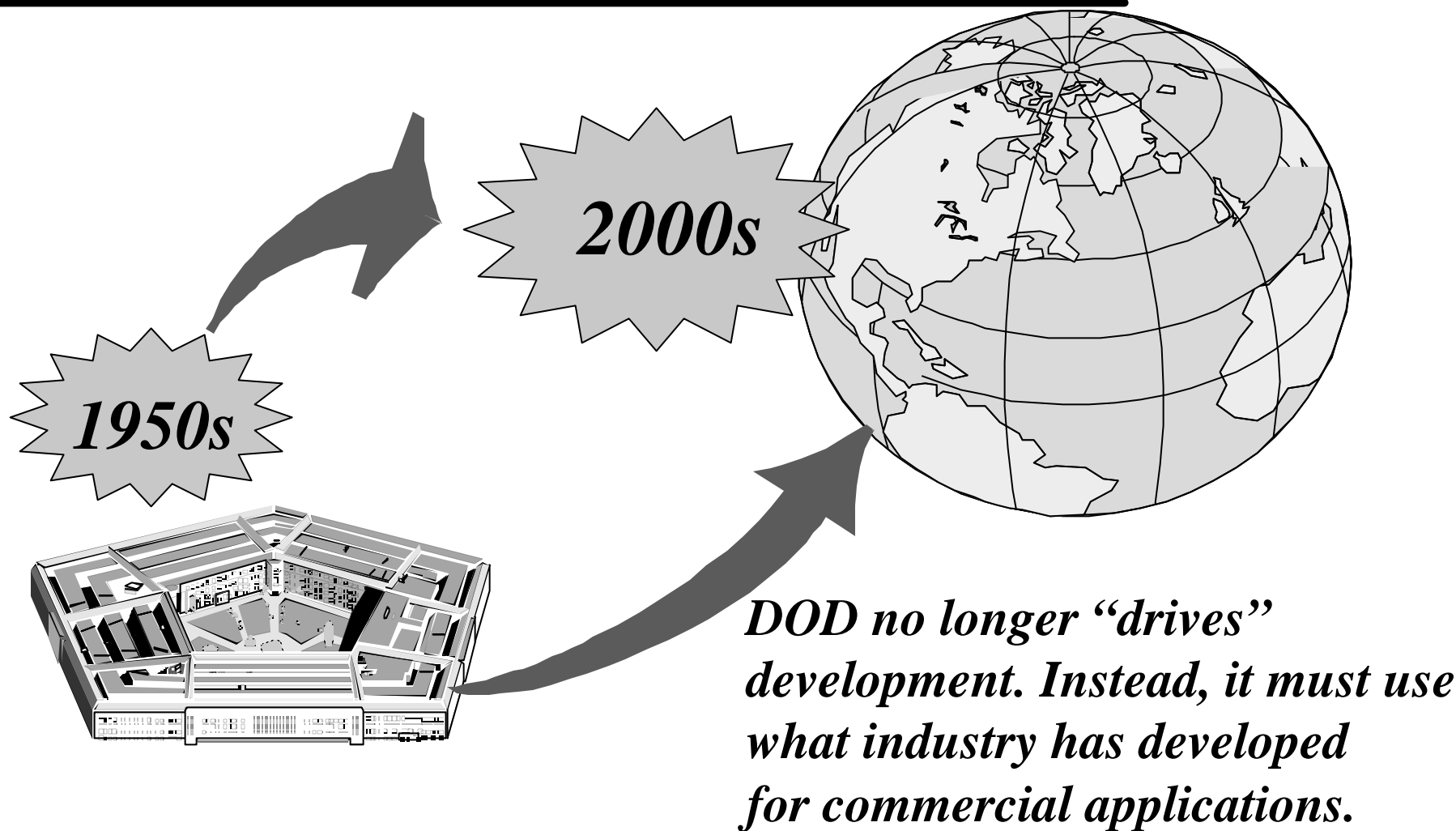
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Why Open Systems? Affordability

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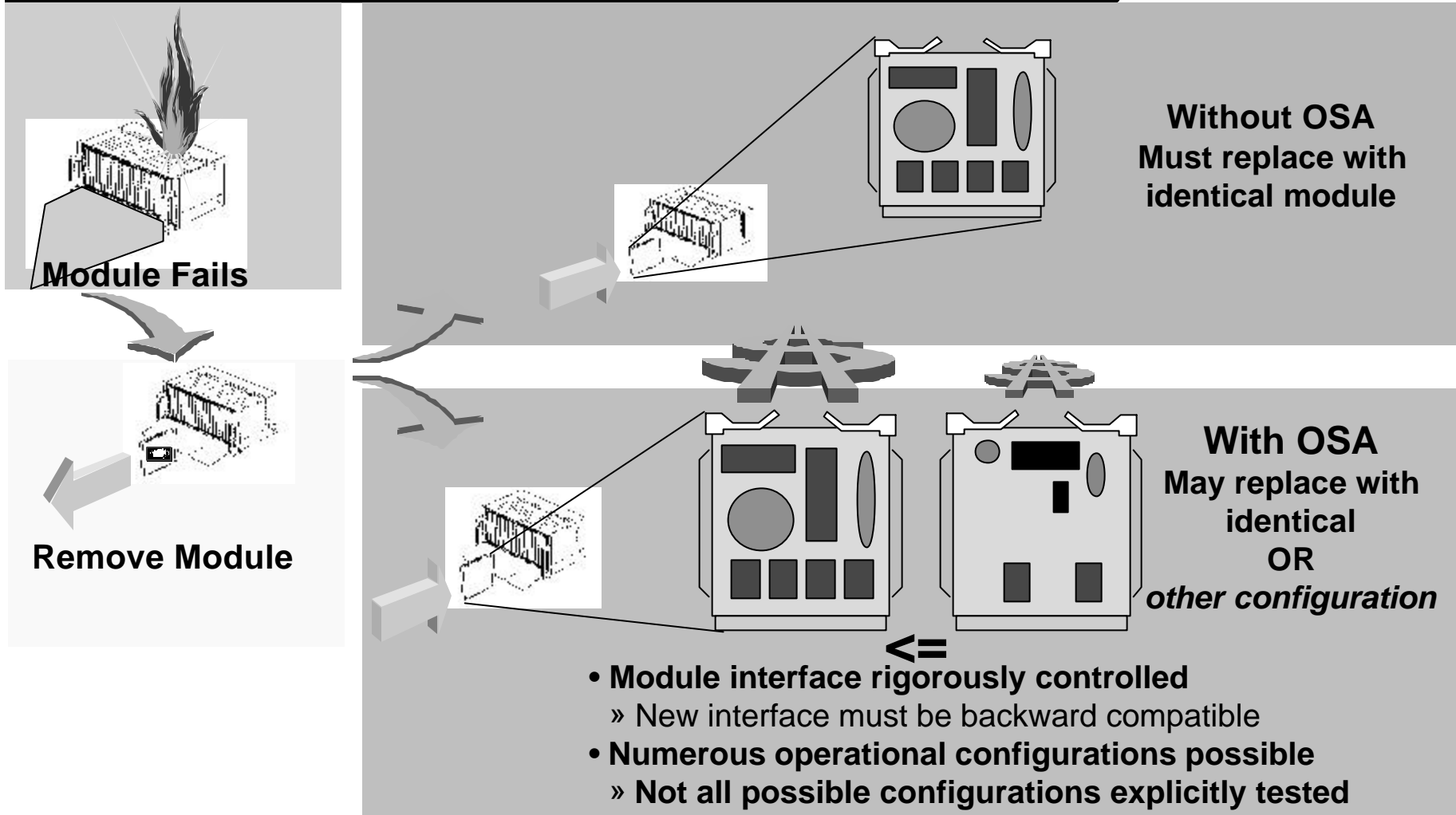
DEVELOPER & PRODUCER



BUYER & INTEGRATOR

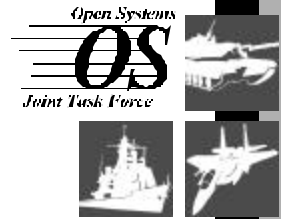
Why Open Systems? Supportability

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Permits new Module Replacement or Upgrade Strategies

What is an Open System?



- Open Systems = Commonality

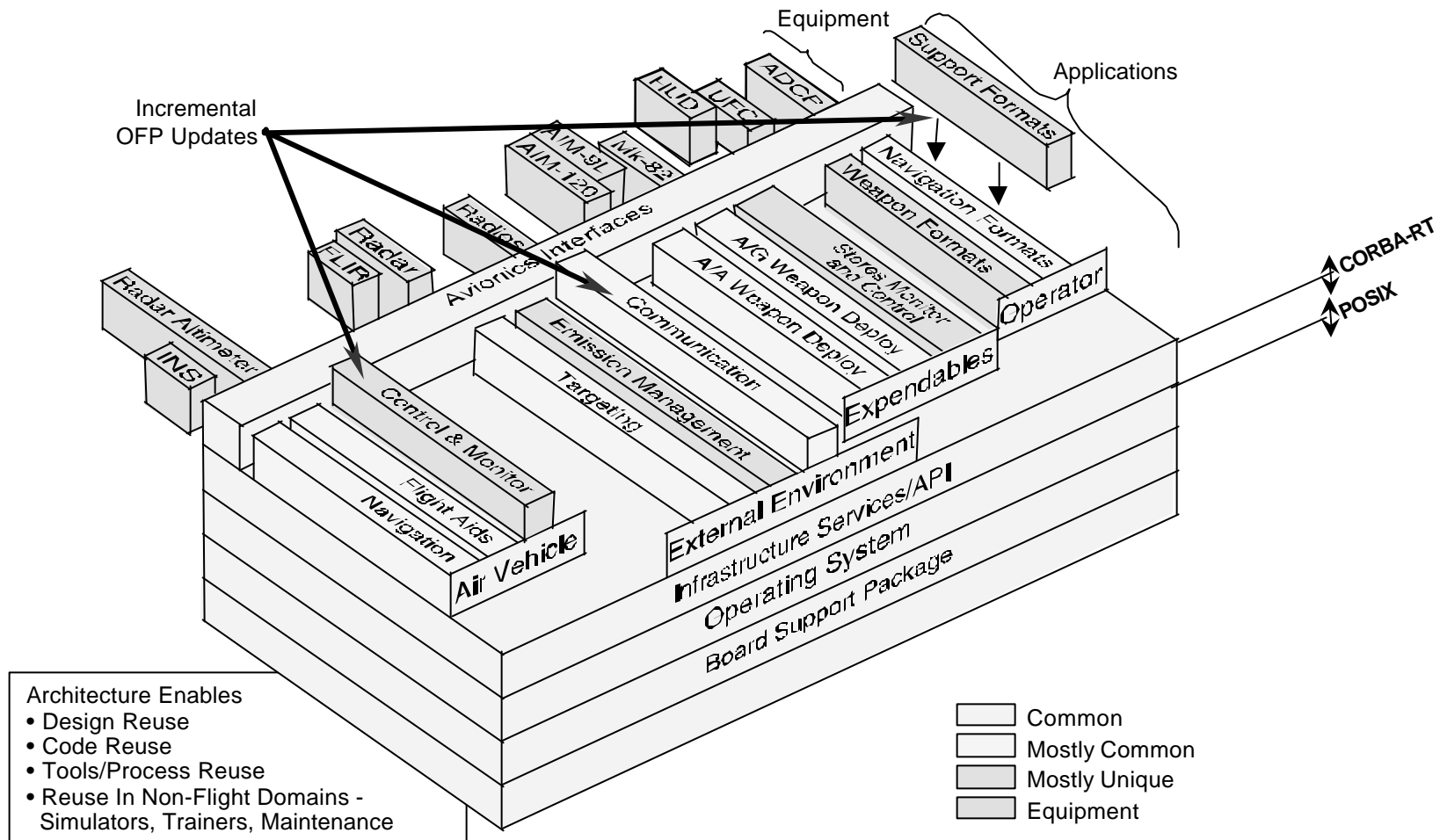
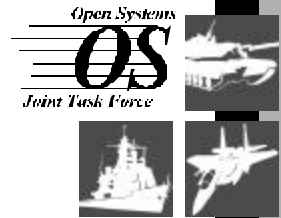
- Open Systems = COTS

- Open Systems = F³ I

- Open Systems = A design based on non-proprietary interface standards broadly accepted and used throughout industry

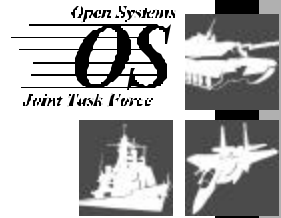
Not Necessarily

What is an Open Systems Architecture?



A Standards-Based Architecture

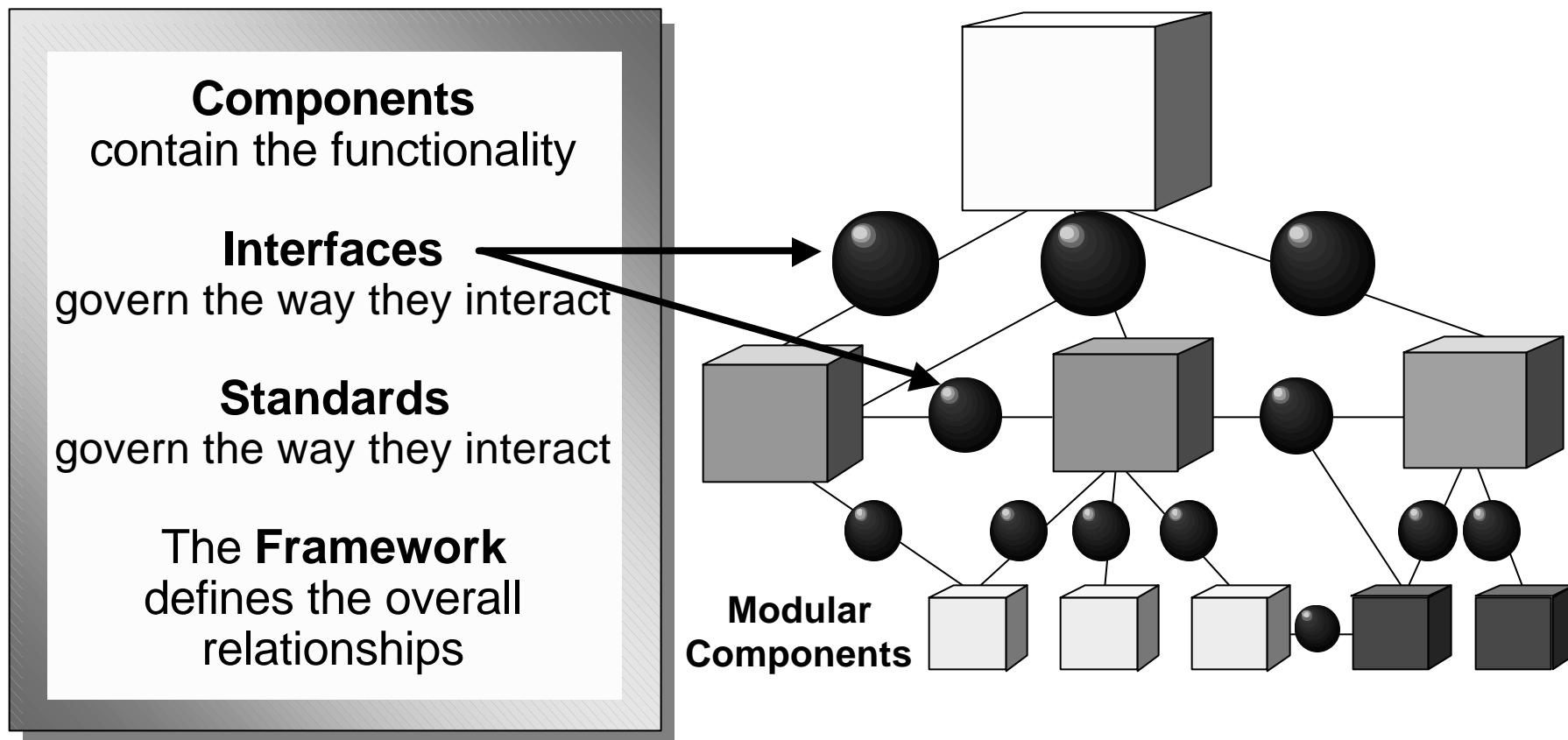
What is an Open Systems Approach?



- An integrated **technical** & business strategy
- **Modular design** of hardware and software
- Applying commercial, widely used **interface standards** in weapon systems
- To buy rather than develop system components

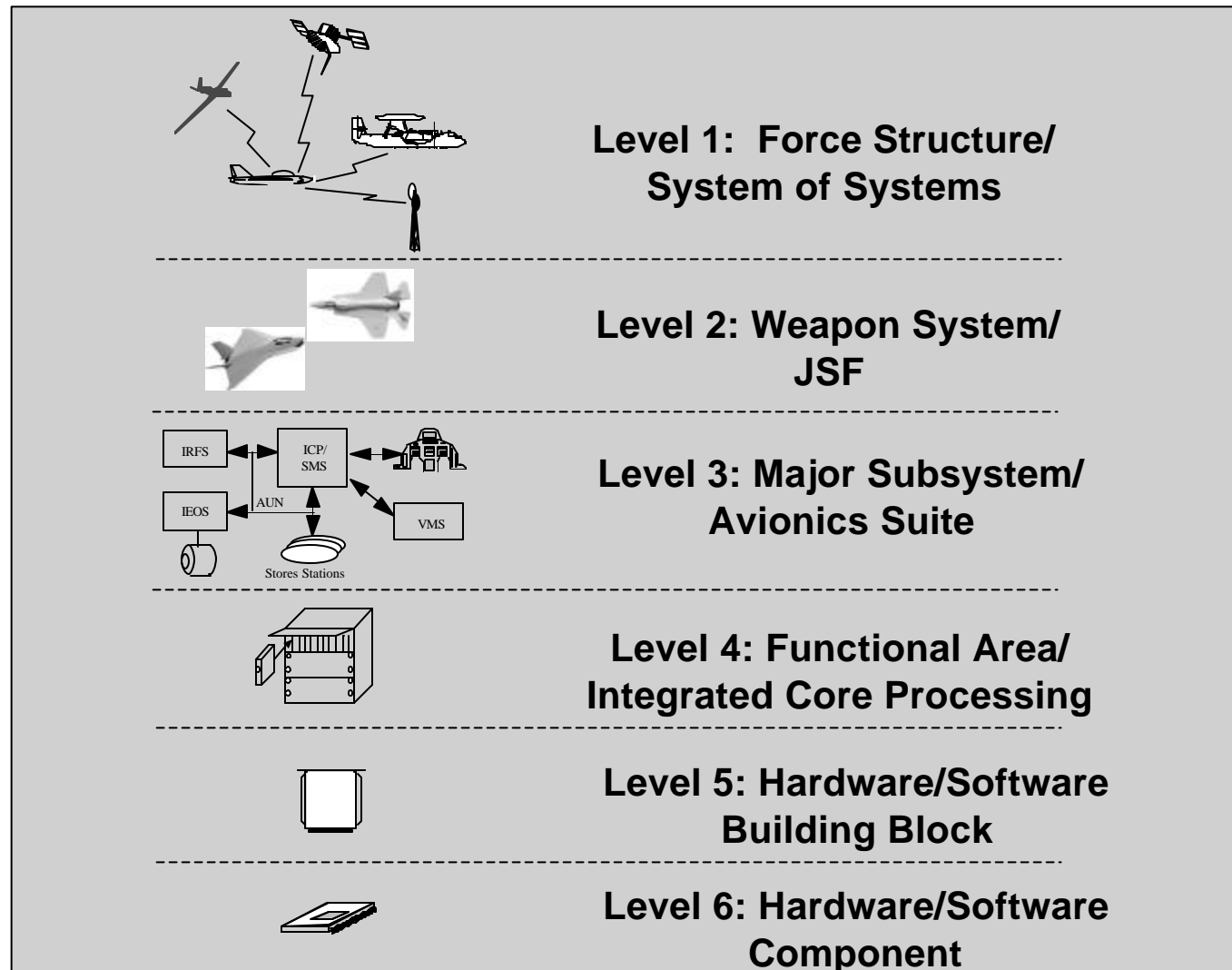
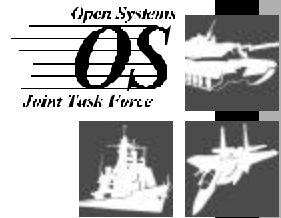
What is Architecture?

“The structure of components, their interrelationships, and the principles governing their design and evolution.” [IEEE STD 610.12]



***An Architecture is not
 a Product or System Description!***

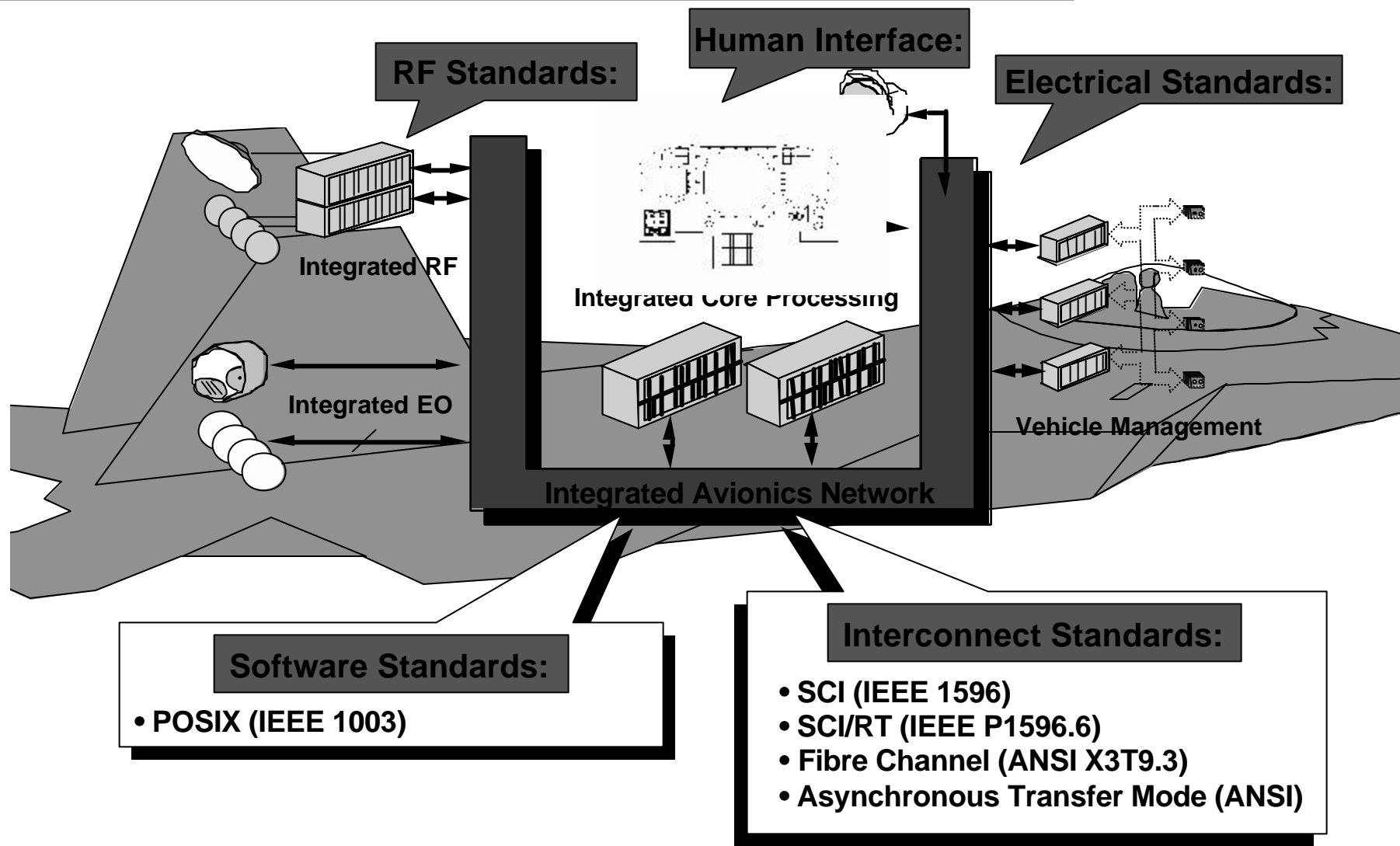
What is Appropriate Level of OSA Application?



Joint Strike Fighter Architectural Hierarchy
Example Context for Avionics Architecture

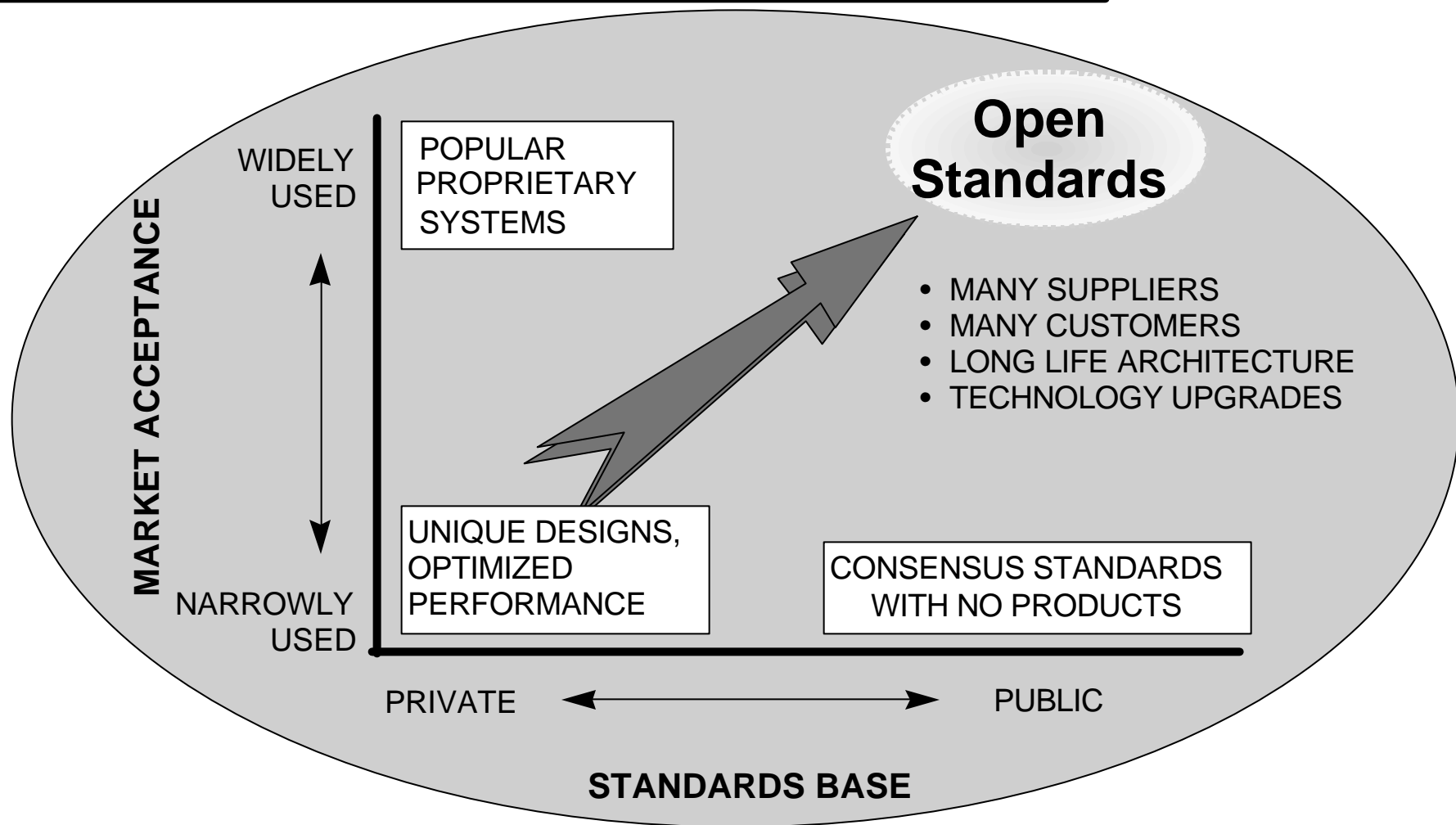
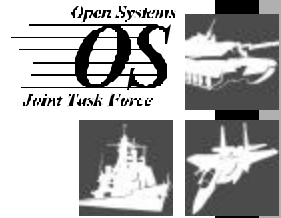
What is the Role of Standards in an Open Systems Approach?

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Well defined interfaces!

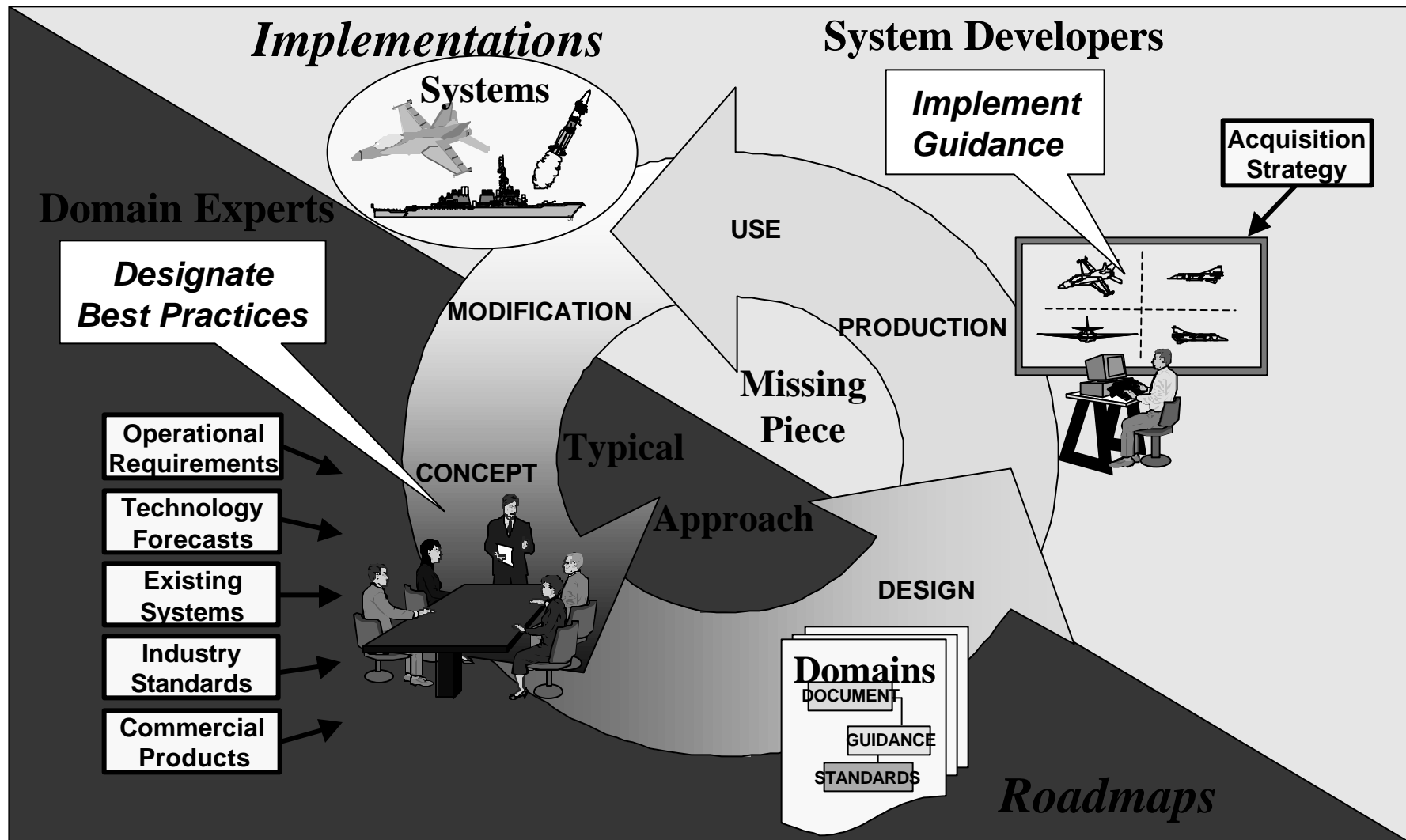
Which Standards Should be Selected?



***Preferably those
Widely Accepted & Supported in the Marketplace***

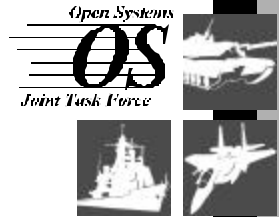
Where is Architecting Performed in a System's Life Cycle?

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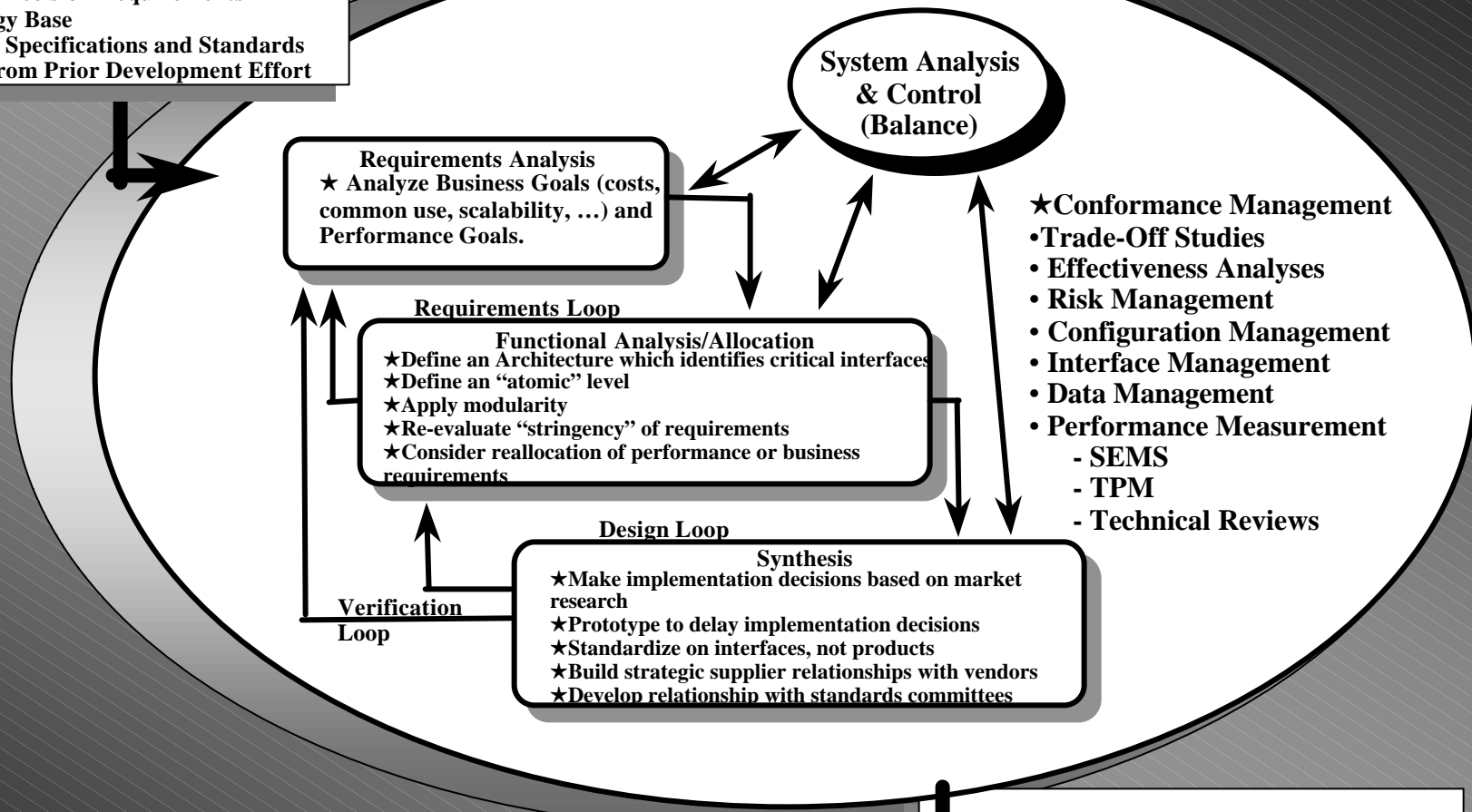
A little bit everywhere!

Where is Architecture Performed in SE Process?



INPUTS

- Customer Needs/Objectives/Requirements
- Program Decision Requirements
- Technology Base
- Technical Specifications and Standards
- Output From Prior Development Effort



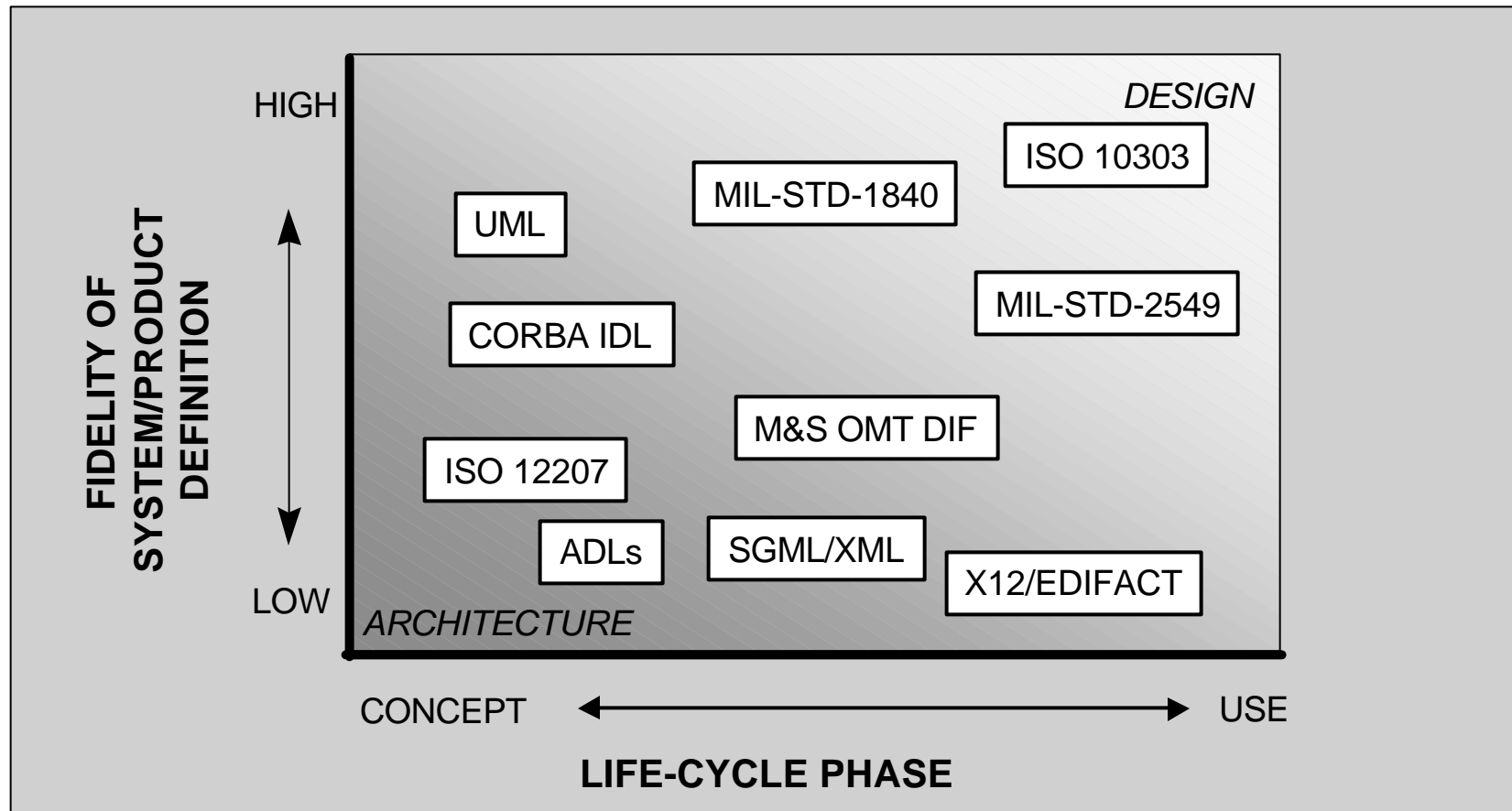
Throughout the process!

OUTPUTS

- System Architecture
- Decision Data Base
- System Architecture & Configuration
- Specifications & Baselines

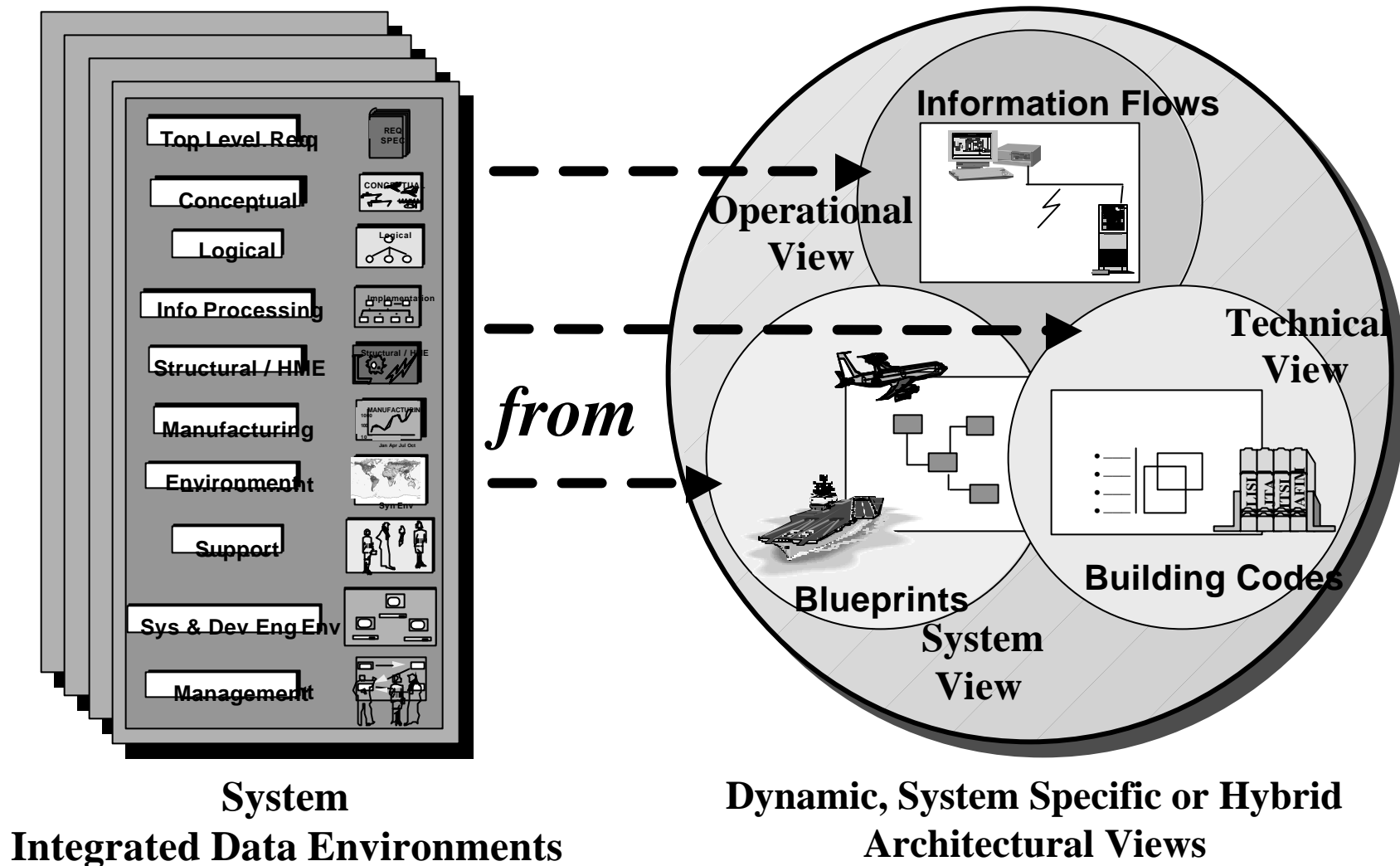
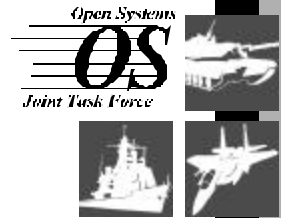


Where is Architecture Data Found?



Throughout the life-cycle!

What is the Relationship of SBA IDEs to Architecture?

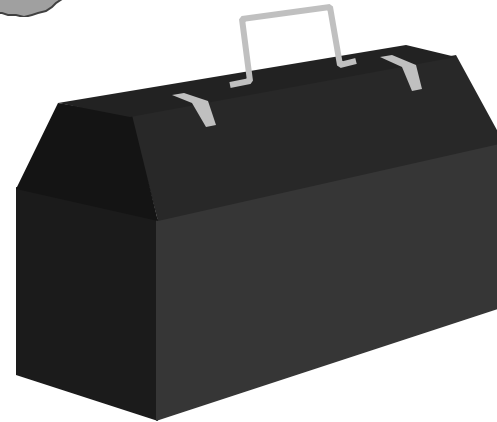
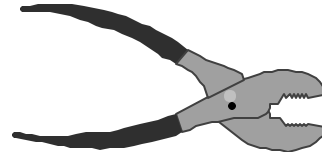


Both define a system!

Architecture Related Tools

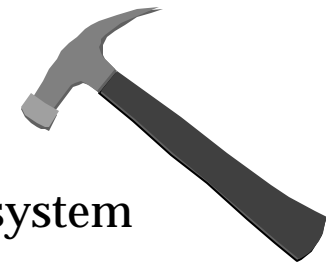
- Major Categories

- Architecture Modeling
- Software Design and Modeling
- Requirements Management
- CAD/CAM
- Product Data Management
- Modeling & Simulation
- Configuration Management



- Observations

- Availability of Architecture Modeling tools are limited and generally oriented to software
- Most tools
 - Rely on proprietary internal data formats
 - Are oriented toward a particular discipline or phase of system life-cycle
 - Don't generally complement each other or work well together
 - Require design partners to adopt a common suite



Practical Experience – AV-8B OSCAR Pilot

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Mission Needs and Operational Requirements Will Continue to Evolve Capabilities

AV-8Bs Must Remain Operationally Capable Through 2023

Two Components Impact ~ 75% of Routine Update Maintenance Cost

Stores Management Computer



2000

Night Attack / Radar

1996

Funded

- GPS
- ATHS
- ARC-210
- OSCAR
- CMWS/ASTE/ALE-47
- VIDEO FATIGUE DATA RECORDER
- DIGITAL FLAP CONTROLLER
- MIL-STD-1760B
- JDAM
- FLIGHT INCIDENT RECORDER
- HQ/SINCGARS
- TAMPs
- TAMMAC
- TARGETING POD/LASER TRACKER
- TAV-8B ENGINE UPGRADE
- VMF DCS-2000
- AMRAAM
- JSOW
- AIM-9X/HMD
- ANTI-SHIP MISSILE

2005

Operationally Suitable

Operationally Effective

Desired

Unfunded

- LINK 16 CAPABILITY
- ALE-50(VX)
- ALR-67(VX)
- IDECM
- VOICE INTERACTION
- MSI
- SELF DIAGNOSTICS



Lessons Learned

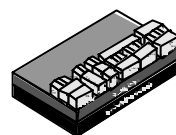


F-15 Advanced Display Core Processor



AV-8B OS Core Avionics Requirement

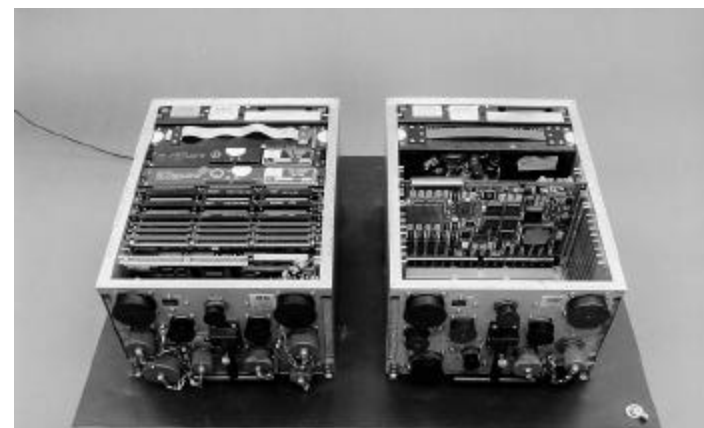
Multipurpose Display Processor



Modular Object Oriented Software
(abandoned in favor of conventional design)



OS Advanced Display Core Processor



Original AYK-14 New Mission Computer

Central Computer

Process

Establish Acquisition Process Guidelines:

- Program Management
- Performance Specs
- Interface Definition
- Supplier Partnerships
- Contracting
- Life Cycle Support

Establish Benchmarks

Pilot Programs

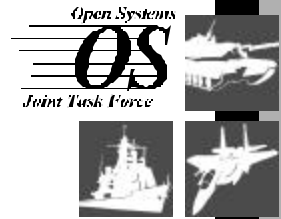
Apply Guidelines
Track to Benchmarks
• Quantify Paybacks

Products

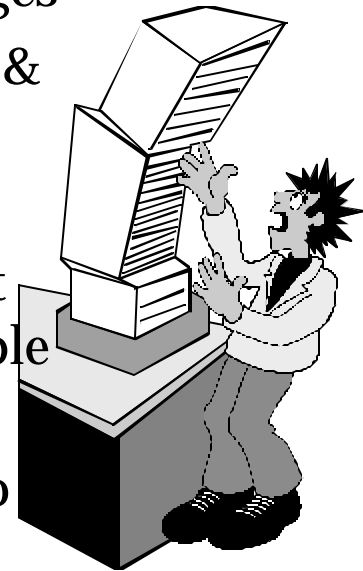
Provide Deliverables:

- Lessons Learned
- Paybacks
 - R&D
 - Procurement
 - O&S

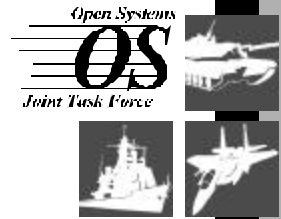
Issues & Challenges



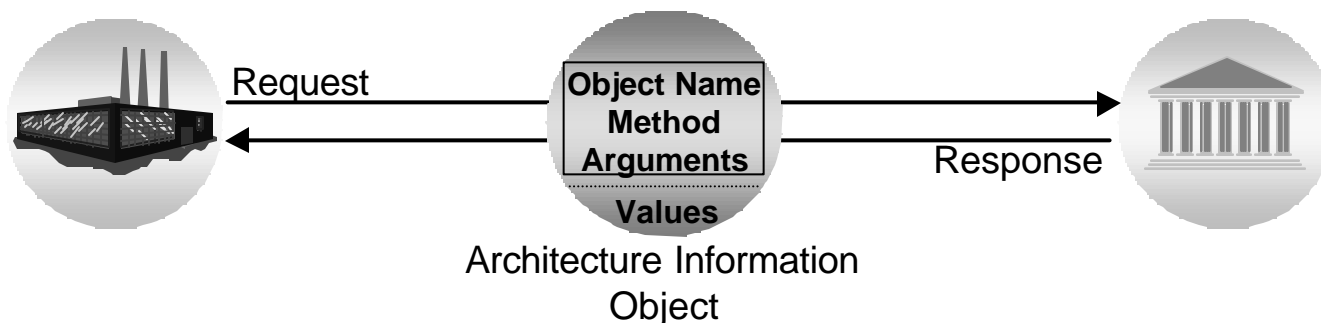
- Several items remain:
 - Protection of proprietary info & competitive advantages
 - Partitioning architecture decisions between customer & supplier
 - Need an “up-front” investment and incentives
 - An architecture is a long-term design plan, it must be supported by a corresponding long term & stable business decisions
 - There may be a one-time cost burden to migrate to the new architecture
 - Keeping the architecture technology independent
 - Definition of architectures in terms that are widely accepted and transcend engineering disciplines and life-cycle phases



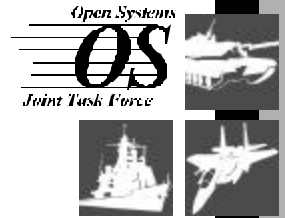
Way Ahead for Definition of Architectures?



- First, identify architecture data in IDE & IPPD environments
- Second, conceive and adopt a universal framework for representing architecture data
 - Results would be something like OAGI, HL7, RosettaNet, xmlEB, BizTalk schemas for architecture and SE process data
 - Two related efforts hold much promise
 - ISO 15288 & 10303 APP 233 efforts
 - OpenGroup Architecture Description Markup Language proposal



Conclusions



- Challenges are mostly social and not technical
- In essence, a Standard Based Architecture approach is about:

Consensus

Collaboration

Communication

Compromise

Integrity

C4I is hard and slow work, so keep the faith!